



IN THE UNITED STATES PATENT AND
TRADEMARK OFFICE

In re application of:
TIMOTHY W. WOMER et al.

) Patent Application
)
)
) APPARATUS FOR PLASTICATING
)
) THERMOPLASTICS
)
)

Attorney Docket No.: 3522.07

INFORMATION DISCLOSURE STATEMENT

McLaughlin & McNally
500 City Centre One
P.O. Box 507
Youngstown, Ohio 44501-0507

February 25, 2002

Assistant Commissioner
of Patents
Washington, D.C. 20231

Dear Sir:

Attached hereto is Form PTO-1449 listing documents believed relevant to the subject application. It is respectfully requested that these documents be considered by the Examiner.

This disclosure document should not be construed as a representation that a search has been made or that no other material information as defined in 37 C.F.R. §1.56(a) exists. It is believed that this disclosure complies with the requirements of 37 C.F.R. §§ 1.56, 1.97, and 1.98, and the Manual of Patent Examining Procedures § 609. If for some reason the examiner considers otherwise, it is

respectfully requested that the undersigned be called so that any deficiencies can be remedied.

A copy of each document is enclosed.

BACKGROUND

To briefly describe the invention without limiting the scope of the claims, this invention relates to extruders and injection machines of the type in which a screw rotatable within a barrel is employed to extrude or inject molten resinous material downstream to an outlet port of the barrel. More specifically, the rotating screw has a main helical flight disposed within and cooperating with the inner wall of a heated barrel. Solid resinous material is introduced to a helical valley extending between said main flight to be heated and plasticized by said machine while being advanced towards the outlet port by the rotation of said screw.

To enhance mixing, a barrier flight is disposed in a barrier melting section intermediate said main flight. The barrier flight and the main flight divide the barrier melting section into a melt channel and a solids channel extending helically side by side. Solid material conveyed along said barrier melting section is positioned adjacent said trailing side of the main flight and melt material conveyed along said barrier melting section is positioned adjacent said push side of the main flight. The barrier flight then discontinues at a terminal end of said barrier melting section and the main helical flight passes into a reorientation section. The melt channel and the solids channel in said barrier melting section merge into a substantially uniform reorientation channel in the reorientation section thereby forcing solid plastic material conveyed along the reorientation section toward the push side of the main flight. Following the reorientation section, a secondary flight becomes disposed in said metering section intermediate the main flight so that solid material conveyed along the metering section is positioned primarily adjacent the push side of the main flight and melt

material conveyed along the metering section is positioned primarily adjacent said trailing side of the main flight.

An advantage of the present invention is that the solid conveyed along the metering section is exposed to higher pressure and sheer at the push side of the main flight.

DISCUSSION

Applicants hereby call to the attention of the Examiner the following patents:

U.S. Patent No. 6,056,430 to Medici, et al.
U.S. Patent No. 5,816,698 to Durina et al.
U.S. Patent No. 5,215,764 to Davis et al.
U.S. Patent No. 4,752,136 to Colby
U.S. patent No. 4,639,143 to Frankland
U.S. Patent No. 4,405,239 to Chung et al.
U.S. Patent No. 4,277,182 to Kruder
U.S. Patent No. 4,227,870 to Kim
U.S. Patent No. 4,215,978 to Takayama et al.
U.S. Patent No. 4,201,481 to Iddon et al.
U.S. Patent No. 4,085,461 to Maillefer
U.S. Patent No. 4,000,884 to Chung
U.S. Patent No. 3,941,535 to Street
U.S. Patent No. 3,652,064 to Lehnens et al.
U.S. Patent No. 3,524,222 to Gregory et al.
U.S. Patent No. 3,486,192 to Le Roy
U.S. Patent No. 3,006,029 to Saxton
U.S. Patent No. 2,753,595 to Dulmage

Medici, Jr. et al., Patent No. 6,056,430, describes a combination barrier/wave section screw with a “interchange” section between the barrier section and wave section. More specifically, Medici, Jr. et al., describes two embodiments as shown therein at Figures 6 and 7. The first embodiment shown in Figure 6 describes a barrier melt section having a main flight (30) and secondary flight (36) dividing the feed channel at the transition into a melt channel and solid channel. The melt channel is on the push side of the main flight. At the terminal end of the barrier

section the primary flight narrows and it's diameter decreases to form a new barrier flight (54). Substantially simultaneously, the secondary flight widens and its diameter increases to form a new primary flight (52). The instant invention does not include the above described "interchange" between the sections (i.e. conversion of the main flight to a barrier flight and the secondary flight to be a primary flight).

The second embodiment of the Medici, Jr. et al. patent shown in Figure 7 therein describes a barrier section identical to the first embodiment. The difference between the first and second embodiments is at the "interchange". At the interchange of the second embodiment, the solid channel (40) narrows and the melt channel (42) simultaneously widens. A wave crest (74) is disposed in the solid channel at a location substantially coinciding with the narrowing of the solids channel to force flow over the secondary flight 36. Thermal and composite mixing is improved by the instant invention by using a more novel "reorientation section" between a multi-channel barrier melting section and an undulating metering section.

Durina, et al, Patent No. 5,816,698 shows a screw having alternating flight and barrier land with a continuous transit channel having a reverse helical direction. Davis, et al, Patent No. 5,215,764 shows a screw having alternating flight and barrier land. The barrier land in Davis, et al., has notches cut through. Colby, Patent No. 4,752,136, Chung, et al., Patent No. 4,405,239 ("Chung '239 Patent"), Knuder, Patent No. 4,277,182 and Chung, Patent No. 4,000,884 ("Chung '884 Patent"), show a screw having relatively shallow and relatively deep helical paths. More specifically, the Chung '884 patent describes a screw having a barrier section comprising a primary thread and a secondary thread dividing the feed channel into a melt channel and solids channel. In the Chung '884 patent, the root diameter of the melt channel, the solid channel and the feed channel,

measured at the origin of the secondary thread, is substantially equal to each other. Also, the secondary thread originates downstream of the feed section by its beginning edge rising from the floor of the feed channel without causing significant interference with the material flow from the feed channel. The primary and secondary threads are substantially parallel and having a substantial constant pitch throughout.

The Chung '239 patent describes a mixing section having a substantially parallel first and second threads. The second thread originates at a location about $\frac{1}{3}$ to $\frac{2}{3}$ length of the screw and divides the feed channel into two sub-channels of substantially equal width. The depth of the front sub-channel gradually increases to maximum, accompanied by a gradual decrease of the depth of the back sub-channel over about $\frac{1}{2}$ to 1 turn of the second thread around the core of the screw. Also, at the end of the depth reversal of the front sub-channel and back sub-channel, the second thread converts to become the first thread with a minimum clearance to the barrel and said first thread converts to become the second thread with a larger clearance to the barrel. Then, the depth reversal between the front sub-channel and back sub-channel is duplicated.

Frankland, Patent No. 4,639,143, shows a screw having a plurality of grooves arranged in a noncontinuous helix cut into the main channel, parallel to the forward helical flight.

Kim, Patent No. 4,227,870 shows a screw having a feeding section, transition section having a plurality of working sections, and a mixing section. In the transition section, there is a shear ring 40 having a plurality of fins 41 separated by a plurality of channels 44. Kim does not show a reorientation section between a multi-channel barrier melting section and an undulating metering section as described and claimed by Applicants.

Takayama, Patent No. 4,215,978, shows a screw having relatively shallow and relatively

deep helical paths.

Iddon, Patent No. 4,201,481, shows a rotatable scroll for a rubber extruding machine having vanes between the flight.

Maillefer, Patent No. 4,085,461, shows a screw having two threads 11 having the same pitch side-by-side. Maillefer shows one of the passing threads 11 having a plurality of radial slots 13.

Street, Patent No. 3,941,535, shows a screw with a portion therein having a plurality of slotted passageways passing through a plurality of flights. The slotted passageways appear to be perpendicular in relation to the axis of the screw.

Lehnner et al., Patent No. 3,652,064, shows a screw having a zone with a counter threaded segment. The counter threaded segment comprises lands having interruptions at intervals.

Le Roy, Patent No. 3,486,192, shows a plurality of inlet and outlet longitudinal grooves.

Saxton Patent No. 3,006,029 shows a screw having a left hand channel cutting through a plurality of flights.

Finally, Dulmage, Patent No. 2,753,595, shows a screw having a plurality of helical lands forming grooves with a cut-through collar 29 through the helical lands.

RESPECTFULLY SUBMITTED,
McLAUGHLIN and McNALLY



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CERTIFICATE OF MAILING

I hereby certify that this Information Disclosure Statement and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this 25th day of February, 2002 in an envelope marked as "Express Mail Post Office to Addressee" having Mailing Label Number EJ286100701US and being addressed to the: Assistant Commissioner of Patents, Washington, D.C. 20231.



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PTO/SB/08A (10-98)

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Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	
(use as many sheets as necessary)				Filing Date	
				First Named Inventor	Timothy Womer, et al.
				Group Art Unit	
				Examiner Name	
Sheet	1	of	1	Attorney Docket Number	3522.07

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number	Kind Code* (if known)			
		6,056,430		Medici, et al.	05-02-00	
		5,816,698		Durina, et al.	10-06-98	
		5,215,764		Davis, et al.	06-01-93	
		4,752,136		Colby	06-21-88	
		4,639,143		Frankland, Jr.	01-27-87	
		4,405,239		Chung, et al.	09-20-83	
		4,277,182		Kruder	07-07-81	
		4,227,870		Kim	10-14-80	
		4,215,978		Takayama, et al.	08-05-80	
		4,201,481		Iddon, et al.	05-06-80	
		4,085,461		Maillefer	04-18-78	
		4,000,884		Chung	01-04-77	
		3,941,535		Street	03-02-76	
		3,652,064		Lehnens, et al.	03-28-72	
		3,524,222		Gregory, et al.	08-18-70	
		3,486,192		Le Roy	12-30-69	
		3,006,029		Saxton	10-31-61	
		2,753,595		Dulmage	07-10-56	

ECBEGN PATENT DOCUMENTS

Examiner Signature		Date Considered	
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EXAMINER: Initial if relevance considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ Unique citation designation number. ² See attached Kinds of U.S. Patent Documents. ³ Enter Office that issued the document, preceded by the two-letter code (WPO Standard ST.C). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Indicate by the appropriate symbol as indicated on the form, or under WPO Standard ST.C, if: